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ABSTRACT

The effect of individualized instruction programs on academic achievement and attitudes of elementary school children was evaluated. It was hypothesized that students in individualized programs would have significantly higher achievement scores and more positive attitudes toward school and self and greater self-direction when compared to their peers. The effects of I.Q., sex, and previous levels of achievement were statistically controlled; the findings were: (a) students in the individualized groups had significantly higher self-direction scores; (b) significant differences were not found in achievement scores (reading comprehension, math concepts, and math problem solving) between the two groups. The sample included 120 fourth grade students from programs in the Nassau and Suffolk County region of New York. (Author)

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# Assessment of the Impact of Individualized Instruction on Students--technical report

Larry J. Maltin

Project Individualized Instruction

(A Regional Approach to Systematic Planning for Individualized Instruction)

Suffolk, BOCES II

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# Assessment of the Impact of Individualized Instruction on Students--technical report

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Project Individualized Instruction
Suffolk, BOCES 2

## Abstract

This evaluation study concerns itself with the effect of individualized instruction programs on academic achievement and attitudes of elementary school children. It was hypothesized that students in individualized programs would have significantly higher achievement scores and more positive attitudes toward school and self, and greater self-direction when compared to their peers. The effects of I.Q., sex, and previous levels of achievement were statistically controlled and the findings were: a) Students in the individualized groups had significantly higher scores on measures of attitude toward self and school, as well as higher self-direction scores, b) Significant differences were not found in achievement scores (reading comprehension, math concepts, and math problem solving) between the two groups. The sample included 120 fourth grade students from programs in the Nassau and Suffolk County region of New York. Fifty high school students, initially selected for inclusion, had to be dropped from the study because of cancellation of the Math 10 regents.

# Assessment of the Impact of Individualized Instruction on Students--technical report

Larry J. Maltin

Suffolk, BOCES II

## Background and Rationale

Project Individualized Instruction (PII), a three year ESEA Title III program, currently in its second year of operations, has as its major objective "To foster the development of Individualized Instruction in the bi-county region of Nassau and Suffolk." The project was brought about by the combined efforts of the Long Island Regional Individualized Learning Council (LIRILC), the BOCES Regional Educational Planning Office (REP), and the four Island Boards of Cooperative Educational Services (BOCES). The District Superintendents of the four Long Island BOCES supervise and coordinate project tasks.

The original project proposal contained two goals. They were:

1. Locate and evaluate current individualized learning programs and practices in Long Island schools,
2. Collect and diffuse individualized learning methods, skills, and techniques, and to identify expertise for the purpose of training beginning and practicing teachers and administrators.

These basic goals have remained the focus of the project. For the second year they were expressed as two major product objectives --the first relating to the location and evaluation of individualization practices; the second addressing the collection and diffusion of these practices to pre- and in-service educators.

Within the first objective, two major emphases have existed. First, the processes of instruction which exemplify individualization have continued to be evaluated. Through refinement of the Individualized Instruction Scale and the writing of a self-application manual, many educators on Long Island were able to both assess their own programs and to be aware of those characteristics which are factors of individualized instruction. The second major emphasis within this broad objective was a new one. For the first time the project staff had assumed the task of assessing the products or output of exemplary individualized programs. Encouragement by the State Education Department resulted in what was a major, innovative effort--the collection of data regarding the effects of exemplary programs on students at the elementary and secondary levels.

This thrust has been a natural outgrowth of the first year's work. With a functioning "process instrument," the I.I. Scale, it was now possible to know with some objectivity, which programs are good examples of individualization. The next step was to determine the effects of these processes on students. Specifically, it was being proposed that there would be significantly higher scores for students in three elementary and one secondary individualized instruction program, when compared to students not involved in highly individualized programs in:

1. Academic Achievement
2. Self-Direction
3. Attitude Toward Self
4. Attitude Toward School

For the purposes of this study, these have been defined as follows:

1. Academic Achievement. Measures of academic achievement for the elementary group were reading and mathematics scores obtained from the May, 1974 administration of the Iowa Test of Basic Skills. For the secondary school sample, measures of achievement were the scores obtained on the June 1974 regents in Euclidian and Coordinate Geometry.

The following three variables have been derived from the California Test of Personality and apply to the elementary school sample only. A separate scale (P. Attitude Scale) was developed by the participating high school for use with its secondary students. This scale is described more fully in the "instruments" section of this report.

2. Self-Direction. The concept of self-direction was defined as a combination of personal freedom and personal responsibility. A student may be said to be self-directed when he believes that he has a reasonable share of the determination of his own conduct and that he perceives himself to be responsible for the outcomes of his behaviors.

3. Attitude Toward Self. The concept of attitude toward self is defined so as to include a sense of personal worth, belonging, and sociability. A pupil feels worthy when he believes he is well regarded by others, that others have faith in his future success, he has at least average ability. A pupil feels that he belongs when he is accepted by his teachers and classmates, and gets along with people in general. A child would normally be regarded as sociable when he seeks to get his satisfaction in ways that are not damaging and unfair to others.

4. Attitude Toward School. The student who has a positive

attitude toward school is the one who feels that his teachers like him, who enjoys being with other students, and who finds the school work adapted to his level of interest and maturity. Good attitude toward school involves the feeling on the part of the student that he "counts for something in the life of the institution."

Hypotheses

It was the purpose of this study to address the following:

1. There will be a significant difference in mathematics and reading achievement scores between students in the individualized instruction program and students in the comparison group, when the effects of sex, aptitude (I.Q.), and previous achievement are taken into consideration.

2. The dispersion of the achievement scores will be greater for students in the individualized instruction program than for students in the comparison group.

3. Measures of self-direction will be higher for students in the individualized program than for students in the comparison group.

4. Measures of attitude toward self will be higher for students in the individualized program than for students in the comparison group.

5. Measures of attitude toward school will be higher for students in the individualized program than for students in the comparison group.

6. Scores of the five dependent variables will be related to level of aptitude.

## Method

Sample

During the Project's first year of activities, 265 programs

had been observed in the bi-county region. Approximately 160 of these programs were elementary and 105 were secondary. Three fourth grade programs were selected from this pool to make up the elementary sample. Criteria for inclusion into the study were:

1. High score on the I.I. Scale,
2. Placement of students in the individualized instruction classes was by random assignment,
3. There was another fourth grade in the same school with a lower score on the I.I. Scale,
4. None of the three programs were from the same geographical area,
5. School personnel involved were willing to cooperate in the study.

Selection of the appropriate secondary program proved to be an extremely difficult task. In situations where there was a highly individualized program, there were no other classes in the same subject area that could serve as a comparison group. Finally, a pilot individualized mathematics program was located which met the above criteria. This program was included in the study.

Procedure

Once the individualized instruction and the comparison groups were identified, meetings were held with the teachers and principals to discuss the purpose of the study, the use to which the findings were to be put, and their responsibilities relative to the study.

The elementary teachers waived the option of administering the instruments themselves, and requested that the PII staff give all the tests. The students were told that their responses to the attitude scales would remain strictly confidential, and so the

teachers were asked to leave the room during administration.

The secondary students were administered their attitude scales by their teachers, but they were not required to put their names on the response sheet. The Math 10 regents was scheduled for June 17, however just prior to that date the examination was cancelled by order of the Commissioner of Education. There was insufficient time remaining before the students recessed for summer vacation to develop another appropriate criterion measure for this sample to be included in the present study.

Instruments

The following are descriptions of the instruments used to obtain data for this study:

The Individualized Instruction Scale (I.I. Scale). This scale, developed by PII, represents a major attempt to quantify individualized instruction. It examines two processes, monitoring and decision making, which facilitate the assignment of instructional strategies. Validity for the items used was sought in terms of agreement with a formal definition of individualized instruction. A jury of educators from Nassau and Suffolk Counties rated each item relative to this definition. The instrument used in the current study was a revised form of the original scale.

The Affective Triad Scale (ATS). The ATS was developed by the PII staff specifically to meet the requriements of the present study. It was designed for use with elementary school children approximately nine years of age. Teachers from Nassau and Suffolk Counties met to develop the basic pool of items from which the scale was derived. The preliminary instrument was piloted and then subjected to an analysis to determine each item's power to discriminate in each of

the three categories.

Lorge-Thorndike Intelligence Test, level 3, form A. Both the verbal and non-verbal tests were administered to those elementary students for whom a recent aptitude score was unavailable.

Iowa Test of Basic Skills (ITBS), form 5, level 10. The ITBS was used as the criterion measure for determining differences in academic achievement between the two groups of elementary students.

Pupil Evaluation Program (PEP). Scores obtained during the previous year's administration of the PEP provided "base-line" scores for the two groups of elementary students.

New York State Math 10 regents in Euclidian and Coordinate Geometry. The Math 10 regents was used as the criterion measure for determining differences in achievement between the two groups of secondary students.

Differential Aptitude Test (DAT). The DAT scores provided "base-line" data for the two groups of secondary students.

P. Attitude Scale (PAS). The PAS was a district developed attitude scale used with the secondary level students to measure differences in attitudes between the two groups. This scale was derived from concepts and items appearing on the Instructional Objectives Exchange (IOX) School Sentiment Index.

## Data Analysis

One objective of experimental design is to ensure that the results observed may be attributed, within limits of error, to the treatment variable and to no other causal circumstance. Usually experimental controls, such as random assignment and matching, are used to ensure freedom from bias. In the present study, because of practical limitations associated with the school setting, a

statistical, rather than an experimental, method was used to "control" the effects of the uncontrolled variables. The Multivariate Analysis of Variance (MANOVA) was selected as being the appropriate procedure.

MANOVA deals with data collected on several dimensions of the same individual. The mathematical model on which the analysis is based is a multivariate normal distribution or a combination of multivariate normal distributions. One clear advantage of this procedure is that it provides more than one criterion by which to measure the effects of the two programs.

In this application the influence of the covariates--sex, intelligence, and previous levels of achievement in reading and math--were removed using a canonical regression method, and the residual sums of squares used to provide variance estimates which in turn were used to make tests of significance for each of the six dependent variables, or criteria.

## Results

The following results were obtained following analysis of the data obtained from the two groups:

1. The test of significance, using Wilks Lambda criterion, indicated that when the effects of sex, I. Q., prior achievement in math and reading were taken into account, there was a significant overall difference between the two groups (p less than .001; see Appendix, p. 5).

Comparisons of scores for the two groups based upon estimates adjusted for the five covariates indicated the following:

a) the comparison group had an adjusted score difference of 1.158 points higher than the individualized group in reading

comprehension (Appendix, p. 3).

b) the individualized group had higher adjusted scores than the comparison group in all other criterion measures. The differences between the two groups ranged from .007 to 2.128 points (Appendix, p. 3).

2. Univariate F tests for each dependent variable, eliminating the effects of the five covariates (Appendix, p. 5), indicated that attitude toward school, and self-direction were significantly higher for the individualized group than for the comparison group (p less than .001). Attitude toward self was more positive for the individualized group than for the comparison group (p less than .055). A difference of that magnitude could be attributed to chance occurrence no more than fifty-five times in a thousand. Random fluctuations could account for differences in the following scores:

a) reading comprehension (p less than .146)

b) math problem solving (p less than .446)

c) math concepts (p less than .989)

3. There was no significant difference in the dispersion of achievement scores between the two groups.

4. Approximately 25% of the variance in the scores could be explained by I. Q. (Appendix, p. 10).

## Discussion

This study attempted to explore the relationship between two methods of instruction, academic achievement, and student attitude changes. The hypothesized relationships between individualized instruction and the dependent variables were only partially confirmed.

The reasons that a significant relationship between individualized instruction and high achievement did not materialize are not entirely clear. Among some of the reasons that might be offered to

possibly account for the similarity in achievement test scores of the two groups, are the following:

1. One school year was an insufficient length of time for exposure to individualized instruction.

2. Some individualized instruction methodology was "carried across the hall" and used by the teachers of the comparison groups and thus the actual methodological differences were not as great as originally indicated.

3. Test-wiseness.

To elaborate on the first point, one might speculate first of all as to whether it was not an over optimistic act of faith to have expected any kind of brief intervention to produce an immediate effect on achievement scores. Perhaps these intervenient procedures and their effects would take a much longer period of time than eight months, to be manifested. The logic of this may be derived from the following line of reasoning. It is possible that achievement is not yet so vital a matter for those nine year olds who are in a high individualized instruction setting. There students are finding themselves in a novel situation where success opportunities are maximized and "there is no failure." Contrast this to the students in the comparison group who are confronted with the reality of encountering "failure." What is suggested here is that, for students in the comparison group, there may be much greater ego-involvement with experienced academic successes and failures. This occurs when the students perceive in "very real terms" how their own performance relates to those of their peers. In contrast to this, for students in the highly individualized group, the consequences of success or failure are more personal and thus less

subject to social exposure and "public humiliation." Therefore, when a child is in a highly individualized program, a much more highly crystalized academic achievement performance attitude might not occur until later in his school career.

The other explanation that seems to require further elaboration is the third, pertaining to test-wiseness. One component of test-wiseness generally acknowledged as having an effect on test performance is time utilization. Teacher concern in the classroom is customarily involved with improving achievement by emphasizing instruction in subject matter. It may be of value to teach the appropriate use of resources other than subject matter resources that are relevant to performance.

A second component of test-wiseness would be familiarity with the testing conditions in general. Both groups were evaluated on a standardized achievement test in a standard test setting. In retrospect, it does seem plausible to consider this condition to have created for the individualized student a very alien working condition, quite unlike the one to which he was accustomed in his classroom where testing was more "personal," questions could always be asked, and generally no specific time limits are imposed. Improved scores, the result of instuction in test taking, would not reflect improved achievement, but would at least reduce the error of mistaking as low achievement that which is partially something else.

Another, less subtle, effect on the achievement scores may have been present because the students in the high individualized group actually may not have been taught some of the content included in the standardized tests. This did not result from any teachers' failure to teach properly, but rather as an artifact of the method

itself. Teachers in the high individualized settings have greater opportunity to deal with each student's areas of deficiencies, no matter how much "class time" is needed. Some of the school year, undoubtedly, had been utilized in this manner, and these students are penalized, therefore, by having less opportunity to learn the subject matter in which they were subsequently evaluated. The fact that they did at least as well as their peers in the comparison group, would seem to suggest that individualized instruction, within the limitations of this study, might be worthy of further examination.

It should be emphasized that the stability of these findings may be questioned due to the small number of students tested, but these results may well offer some suggestions as to the direction of future research.

Finally, the discussion would be incomplete without reference to an extremely important limiation of these results. Extreme caution should be exercised in generalizing from these results since the three groups may not necessarily represent a true sample of elementary school programs. The effectiveness of the procedure, both in terms of differences in achievement scores and affective measures, remain to be assessed in a larger sample of students. Similarly, the effectiveness of individualized instruction as determined in this study, applies only to the specific stduents, the specific schools, and other specific aspects of the total situation.

## Conclusions

The following statements are offered in conclusion regarding the effects of individualized instruction on students and within the limitations imposed by the specifics of this study:

1. Students in individualized instruction programs do as well

as their peers in the comparison groups in reading comprehension, math concepts and math problem solving.

2. There does not appear to be any significant difference between the two groups in the dispersion of achievement scores.

3. Students in individualized instruction programs have a significantly more positive sense of self-direction than their peers in the comparison groups.

4. Students in individualized instruction programs have a considerably more positive self-attitude than their peers. Although this difference failed to achieve statistical significance at the customary level of acceptance, a difference of the observed magnitude ($p$ less than .055) is great enough to warrant further serious consideration.

5. Students in individualized instruction programs have a significantly more positive attitude toward school than their peers in the comparison groups.

6. Twenty-five percent of the observed variance between the groups can be accounted for by partialling out the effect of intelligence.

In a more general sense, one may conclude from this study that although the differences in achievement between both groups was not statistically significant, the differences in attitudes, particularly as relating to school, were significant. This may well be the critical point, for attitudes toward school are very important in the very human sense that it is better to be satisfied than discontent doing what one must do anyway.

## References

Anderson, T. An Introduction to Multivariate Statistical Analysis. J. Wiley & Sons, Inc., New York 1958.

California Test of Personality, 1953 Revision. California Test Bureau, Monterey California.

Morrison, Donald F. Multivariate Statistical Methods. McGraw Hill, New York 1967.

# Appendix

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*** ANALYSIS FOR L.MALTIN - ALL SCHOOLS **

PROBLEM 1 11 VARIABLES 1 FACTORS

SEX IQ PEP-READ PREV-MATH PREV-PROB READ-COMP MATH-CON MATH-PROB ATT-SCHOOL SELFDIR
ATT-SELF

6 CRITERIA 5 COVARIATES WITH THE FOLLOWING VARIABLES
READ-COMP MATH-CON MATH-PROB ATT-SCHOOL SELFDIRECT ATT-SELF SEX IQ PEP-READ PREV-MA
PREV-PROB

FACTOR A 2 LEVELS II
DEVIATION CONTRASTS

FORMAT OF DATA CARDS
(2X,I1,2X,F1.0,1X,F3.0,3(3X,F2.0),15X,3(3X,F2.0),/,58X,F2.0,3X,F2.0,5X,F
2.0)

OBSERVATION 1 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 4 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 7 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 14 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 1
OBSERVATION 21 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 23 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 35 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 1
OBSERVATION 37 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 1
OBSERVATION 53 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 54 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 55 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 61 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 64 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 65 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 67 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 71 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 77 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 1
OBSERVATION 93 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 1
OBSERVATION 104 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 108 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 126 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 2
OBSERVATION 127 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 1
OBSERVATION 133 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 1
OBSERVATION 135 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 1
OBSERVATION 144 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 1
OBSERVATION 146 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 1
OBSERVATION 147 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL 1

2 CELLS

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| FACTOR A | | | VARIABLE SEX | IQ | PEP-READ | PREV-MATH | PREV-PROB | READ-COMP | MATH-CON | MATH-PROB |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 60 OBS | M | 0.517 | 106.383 | 28.600 | 15.217 | 10.017 | 34.133 | 19.933 | 14.36 |
| | | SD | 0.504 | 15.100 | 13.207 | 4.026 | 4.542 | 13.782 | 7.003 | 6.14 |
| 2 | 60 OBS | M | 0.533 | 107.067 | 27.817 | 14.133 | 8.900 | 35.933 | 19.400 | 13.60 |
| | | SD | 0.503 | 14.561 | 11.648 | 4.764 | 4.775 | 13.879 | 7.138 | 6.33 |

| FACTOR A | | | VARIABLE ATT-SCHOOL | SELFDIRECT | ATT-SELF |
|---|---|---|---|---|---|
| 1 | 60 OBS | M | 11.150 | 13.983 | 26.267 |
| | | SD | 2.503 | 3.838 | 8.663 |
| 2 | 60 OBS | M | 8.950 | 9.733 | 23.550 |
| | | SD | 3.291 | 3.069 | 8.520 |

COMPLETE FACTORIAL WITH NO MISSING CELLS

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| VARIABLE | READ-COMP | MATH-CON | MATH-PROB | ATT-SCHOOL | SELFDIRECT | ATT-SELF |
|---|---|---|---|---|---|---|
| READ-COMP | 8.476 | | | | | |
| MATH-CON | 0.366 | 4.144 | | | | |
| MATH-PROB | 0.345 | 0.414 | 3.943 | | | |
| ATT-SCHOOL | 0.024 | 0.077 | 0.075 | 2.746 | | |
| SELFDIRECT | -0.102 | 0.097 | 0.097 | 0.444 | 3.089 | |
| ATT-SELF | 0.030 | 0.125 | 0.122 | 0.556 | 0.394 | 7.826 |

ESTIMATES ADJUSTED FOR 5 COVARIATES

| CONTRAST | CRITERIA READ-COMP | MATH-CON | MATH-PROB | ATT-SCHOOL | SELFDIRECT | ATT-SELF |
|---|---|---|---|---|---|---|
| A | | | | | | |
| 1 | -1.158 | 0.007 | 0.282 | 1.077 | 2.128 | 1.417 |

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TESTS OF SIGNIFICANCE USING WILKS LAMBDA CRITERION AND CANONICAL CORRELATIONS

| TEST OF ROOTS | F | DFHYP | DFERR | P LESS THAN | R |
|---|---|---|---|---|---|
| 1 THROUGH 5 | 8.967 | 30.000 | 434.000 | 0.001 | 0.871 |
| 2 THROUGH 5 | 2.970 | 20.000 | 379.977 | 0.001 | 0.548 |
| 3 THROUGH 5 | 1.404 | 12.000 | 308.955 | 0.162 | 0.312 |
| 4 THROUGH 5 | 0.884 | 6.000 | 219.000 | 0.508 | 0.211 |
| 5 THROUGH 5 | 0.136 | 2.000 | 110.000 | 0.873 | 0.050 |

| VARIABLE | UNIVARIATE F TESTS F( 5, 113) | MEAN SQ | P LESS THAN | STANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS 1 | 2 |
|---|---|---|---|---|---|
| READ-COMP | 40.242 | 2890.970 | 0.001 | 0.486 | 0.525 |
| MATH-CON | 46.105 | 791.865 | 0.001 | 0.454 | -0.643 |
| MATH-PROB | 36.474 | 567.087 | 0.001 | 0.333 | -0.120 |
| ATT-SCHOOL | 4.140 | 31.229 | 0.002 | -0.087 | 0.099 |
| SELFDIRECT | 7.262 | 69.294 | 0.001 | 0.186 | 0.626 |
| ATT-SELF | 5.348 | 358.112 | 0.001 | 0.067 | 0.312 |

RAW REGRESSION COEFFICIENTS

| | VARIATES | | | | | |
|---|---|---|---|---|---|---|
| COVARIATES | READ-COMP | MATH-CON | MATH-PROB | ATT-SCHOOL | SELFDIRECT | ATT-SELF |
| SEX | 0.368 | 0.755 | -1.012 | -0.002 | -0.792 | -0.774 |
| IQ | 0.470 | 0.258 | 0.256 | -0.020 | 0.009 | 0.063 |
| PEP-READ | 0.281 | -0.019 | 0.007 | 0.110 | 0.151 | 0.335 |
| PREV-MATH | 0.883 | 0.463 | 0.346 | -0.039 | 0.076 | 0.357 |
| PREV-PROB | -0.299 | 0.198 | -0.017 | -0.011 | -0.191 | -0.660 |

TESTS OF SIGNIFICANCE USING WILKS LAMBDA CRITERION AND CANONICAL CORRELATIONS

| TEST OF ROOTS | F | DFHYP | DFERR | P LESS THAN | R |
|---|---|---|---|---|---|
| 1 THROUGH 1 | 9.485 | 6.000 | 108.000 | 0.001 | 0.587 |

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| | UNIVARIATE F TESTS | | | STANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS |
|---|---|---|---|---|
| VARIABLE | F( 1, 113) | MEAN SQ | P LESS THAN | 1 |
| READ-COMP | 2.145 | 154.050 | 0.146 | 0.096 |
| MATH-CON | 0.000 | 0.003 | 0.989 | 0.075 |
| MATH-PROB | 0.586 | 9.113 | 0.446 | -0.085 |
| ATT-SCHOOL | 17.679 | 133.350 | 0.001 | -0.286 |
| SELFDIRECT | 54.525 | 520.272 | 0.001 | -0.925 |
| ATT-SELF | 3.769 | 230.816 | 0.055 | 0.270 |

DISCRIMINANT SCORES

| CONTRAST | 1 |
|---|---|
| 1 | -0.720 |

HOFSTRA UNIVERSITY  MULTIVARIATE ANALYSIS OF VARIANCE

*** ANALYSIS FOR L.MALTIN - ALL SCHOOLS ***

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PROBLEM 1  11 VARIABLES  1 FACTORS

SEX  IQ  PEP-READ  PREV-MATH  PREV-PROB  READ-COMP  MATH-CON  MATH-PROB  ATT-SCHOOL  SELFDIREC
ATT-SELF

6 CRITERIA  1 COVARIATES  WITH THE FOLLOWING VARIABLES
READ-COMP  MATH-CON  MATH-PROB  ATT-SCHOOL  SELFDIRECT  ATT-SELF  IQ

FACTOR A  2 LEVELS  II
DEVIATION CONTRASTS

FORMAT OF DATA CARDS
(2X,I1,2X,F1.0,1X,F3.0,3(3X,F2.0),15X,3(3X,F2.0),/,58X,F2.0,3X,F2.0,5X,F
2.0)

OBSERVATION  1 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  4 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  7 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  14 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  1
OBSERVATION  21 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  23 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  35 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  1
OBSERVATION  37 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  1
OBSERVATION  53 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  54 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  55 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  61 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  64 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  65 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  67 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  71 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  77 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  1
OBSERVATION  93 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  1
OBSERVATION  104 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  108 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  126 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  2
OBSERVATION  127 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  1
OBSERVATION  133 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  1
OBSERVATION  135 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  1
OBSERVATION  144 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  1
OBSERVATION  146 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  1
OBSERVATION  147 OMITTED FROM ANALYSIS BECAUSE OF MISSING DATA, CELL  1

2 CELLS

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MEANS AND STANDARD DEVIATIONS

| FACTOR A | | | VARIABLE SEX | IQ | PEP-READ | PREV-MATH | PREV-PROB | READ-COMP | MATH-CON | MATH-PROB |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 60 OBS | | | | | | | | | |
| | | M | 0.517 | 106.383 | 28.600 | 15.217 | 10.017 | 34.133 | 19.933 | 14.367 |
| | | SD | 0.504 | 15.100 | 13.207 | 4.026 | 4.542 | 13.782 | 7.003 | 6.142 |
| 2 | 60 OBS | | | | | | | | | |
| | | M | 0.533 | 107.067 | 27.817 | 14.133 | 8.900 | 35.933 | 19.400 | 13.600 |
| | | SD | 0.503 | 14.561 | 11.648 | 4.764 | 4.775 | 13.879 | 7.138 | 6.333 |

| FACTOR A | | | VARIABLE ATT-SCHOOL | SELFDIRECT | ATT-SELF |
|---|---|---|---|---|---|
| 1 | 60 OBS | | | | |
| | | M | 11.150 | 13.983 | 26.267 |
| | | SD | 2.503 | 3.838 | 6.663 |
| 2 | 60 OBS | | | | |
| | | M | 8.950 | 9.733 | 23.550 |
| | | SD | 3.291 | 3.069 | 8.520 |

COMPLETE FACTORIAL WITH NO MISSING CELLS

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WITHIN CELLS CORRELATIONS OF CRITERIA WITH STANDARD DEVIATIONS ON DIAGONAL ADJUSTED FOR 1 COVARIATES

| VARIABLE | READ-COMP | MATH-CON | MATH-PROB | ATT-SCHOOL | SELFDIRECT | ATT-SELF |
|---|---|---|---|---|---|---|
| READ-COMP | 9.161 | | | | | |
| MATH-CON | 0.434 | 4.651 | | | | |
| MATH-PROB | 0.390 | 0.461 | 4.050 | | | |
| ATT-SCHOOL | 0.103 | 0.051 | 0.068 | 2.906 | | |
| SELFDIRECT | 0.012 | 0.043 | 0.101 | 0.515 | 3.345 | |
| ATT-SELF | 0.123 | 0.090 | 0.130 | 0.588 | 0.477 | 8.251 |

ESTIMATES ADJUSTED FOR 1 COVARIATES

| CONTRAST | CRITERIA | | | | | |
|---|---|---|---|---|---|---|
| A | READ-COMP | MATH-CON | MATH-PROB | ATT-SCHOOL | SELFDIRECT | ATT-SELF |
| 1 | -0.661 | 0.390 | 0.493 | 1.110 | 2.148 | 1.416 |

TEST OF WITHIN CELLS REGRESSION

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TESTS OF SIGNIFICANCE USING WILKS LAMBDA CRITERION AND CANONICAL CORRELATIONS

| TEST OF ROOTS | F | DFHYP | DFERR | P LESS THAN | R |
|---|---|---|---|---|---|
| 1 THROUGH 1 | 41.506 | 6.000 | 112.000 | 0.001 | 0.831 |

| | UNIVARIATE F TESTS | | | STANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS |
|---|---|---|---|---|
| VARIABLE | F( 1, 117) | MEAN SQ | P LESS THAN | 1 |
| READ-COMP | 151.961 | 12753.365 | 0.001 | 0.434 |
| MATH-CON | 155.781 | 3369.475 | 0.001 | 0.381 |
| MATH-PROB | 162.915 | 2672.804 | 0.001 | 0.431 |
| ATT-SCHOOL | 2.443 | 20.624 | 0.121 | -0.111 |
| SELFDIRECT | 10.345 | 115.740 | 0.002 | 0.170 |
| ATT-SELF | 10.958 | 745.932 | 0.001 | 0.046 |

RAW REGRESSION COEFFICIENTS

| | VARIATES | | | | | |
|---|---|---|---|---|---|---|
| COVARIATES | READ-COMP | MATH-CON | MATH-PROB | ATT-SCHOOL | SELFDIRECT | ATT-SELF |
| IQ | 0.701 | 0.360 | 0.321 | 0.028 | 0.067 | 0.170 |

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TEST OF A

TESTS OF SIGNIFICANCE USING WILKS LAMBDA CRITERION AND CANONICAL CORRELATIONS

| TEST OF ROOTS | F | DF HYP | DFERR | P LESS THAN | R |
|---|---|---|---|---|---|
| 1 THROUGH 1 | 9.173 | 6.000 | 112.000 | 0.001 | 0.574 |

| | UNIVARIATE F TESTS | | | STANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS |
|---|---|---|---|---|
| VARIABLE | F( 1, 117) | MEAN SQ | P LESS THAN | 1 |
| READ-COMP | 0.624 | 52.332 | 0.431 | 0.206 |
| MATH-CON | 0.842 | 18.219 | 0.361 | -0.128 |
| MATH-PROB | 1.777 | 29.149 | 0.185 | -0.132 |
| ATT-SCHOOL | 17.490 | 147.673 | 0.001 | -0.295 |
| SELFDIRCT | 49.453 | 553.272 | 0.001 | -0.938 |
| ATT-SELF | 3.534 | 240.559 | 0.063 | 0.376 |

DISCRIMINANT SCORES

| CONTRAST | 1 |
|---|---|
| 1 | -0.692 |